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THE CHEMICAL COMPOSITION OF AMERICAN GRAPES GROWN IN THE CENTRAL AND EASTERN STATES.

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INTRODUCTION.

This report on the composition of native American grapes is supplementary to that published as Bureau of Chemistry Bulletin 145,[1] which contains a general statement of the plans of the work. Although final opinion as to the range in chemical composition of the different varieties of grapes grown in various districts may require more study, the values commonly found are indicated by the results given in these two reports.

EXTENT OF INVESTIGATION.

Fewer samples were handled at the Sandusky and Charlottesville laboratories during the season of 1911 than in the two previous years, but care was taken to secure representative samples of the varieties analyzed. The field work in 1912 was devoted to other questions than variety examinations.

In 1913 the work was largely transferred to new territory and to districts not adequately covered in previous years. The collection and analysis of samples were limited to samples from New Jersey and New York for table and wine grapes and to samples of the

[1] Alwood, William B. Enological Studies, No. 4. The Chemical Composition of American Grapes Grown in Ohio, New York, and Virginia. U. S. Dept. Agr. Bur. Chem. Bul. 145. 1911.

rotundifolia grapes from North Carolina. In New Jersey the territory about Vineland and Egg Harbor was fairly well covered, and representative samples were collected and sent to the food and drug inspection laboratory at Philadelphia, where they were analyzed. In New York the region about Keuka Lake was covered and representative samples of table and wine grapes were collected and sent to the food and drug inspection laboratory at Buffalo, where they were analyzed. Further collections in New York were made of the Concord variety from the Chautauqua district. In this district and the adjacent northwestern part of Pennsylvania are located the largest grape-juice factories in the world; they use only Concord grapes for making grape juice.

During this investigation samples of every variety of grapes found in cultivation in the territory covered have been taken purposely because the available data on the composition of American native grapes were very inadequate.

Up to the present time, of the many varieties of grapes put out by the plant propagators, only a few have proved sufficiently valuable to warrant extensive cultivation. Yet it is important in a general investigation to make a fairly complete examination of all varieties found in cultivation until sufficient information as to their composition is available from which to obtain a basis for more discriminating work.

COLLECTION OF SAMPLES.

The sampling in 1911 was done almost wholly by persons employed temporarily by the Bureau of Chemistry and in a few instances by volunteer assistants. These assistants lived in the locality where the samples were taken and were engaged for this work because of their knowledge of the varieties. Every precaution was taken to secure samples which represented the average of the crop. The preparation and treatment of the samples during analysis were the same as described in Bulletin 145.[2]

The sampling in New Jersey and in the Keuka district in New York in 1913 was done by a member of the Bureau of Chemistry who personally visited the growers and collected samples of ripe fruit typical of each variety and crop. The samples reached the laboratory in good condition in both cases.

The sampling of Concord grapes in the Chautauqua district in 1913 was done at one of the large grape-juice factories. Certain crops were sampled six times between October 10 and 21 and in each case average fruit was taken. Care was observed to select crops which represented the different soil formations of the district. Eight crops were sampled on each date and in every instance a composite of these

[2] Ibid, pp. 9–11.

samples was made and analyzed. Analyses of 34 individual samples were also made.

The samples taken in North Carolina were selected in the vineyards by J. H. Jeffries, superintendent of the Pender Experiment Farm, which is owned and operated by the North Carolina State Board of Agriculture. Mr. Jeffries kindly undertook this work and sent the samples to Raleigh, where they were analyzed. Dr. B. W. Kilgore, chief chemist for the State Board of Agriculture at Raleigh, furnished laboratory room, apparatus, etc., and gave every assistance possible.

CHEMICAL COMPOSITION OF GRAPES EXAMINED.

The data represented in Tables 1 and 2 are arranged by localities, and the average, maximum, and minimum results are given when more than one sample was taken for each locality; a total average of all the analyses of each variety is given with maximum and minimum results as to solids, sugar, and acid on all the samples of any given variety examined. The specific gravity determined by a pycnometer at 15.6° C. is given individually for all single samples and the average is given where two or more samples are recorded for any locality. The determinations as to composition are given in grams in 100 cc of expressed juice.

TABLE 1.—*Composition of American native grapes; average, maximum, and minimum data.*

[Results stated in grams per 100 cc of expressed juice.]

SAMPLES FROM OHIO, NEW YORK, AND PENNSYLVANIA, 1911; EXAMINED AT SANDUSKY, OHIO; EOFF AND SHERWOOD, ANALYSTS.

Variety and locality.	Number of samples.	Brix.	Average specific gravity.	Total solids.			Sugar-free solids.			Sugar as invert.			Acid as tartaric.		
				Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.
BACCHUS.															
Kelleys Island, Ohio	2	20.4	1.0852	22.15	23.28	21.02	3.36	3.58	3.14	18.79	20.14	17.44	1.174	1.282	1.065
Geneva, N. Y.	1	19.7	1.0811	21.07	.....	.....	3.64	.....	.....	17.43	.....	.....	1.702	.....	.....
Averages, limits, and totals	3	20.2	1.0838	21.79	23.28	21.02	3.45	3.64	3.14	18.34	20.14	17.43	1.347	1.702	1.065
CATAWBA.															
Kelleys Island, Ohio	6	20.3	1.0860	22.36	23.49	21.52	2.63	2.85	2.46	19.73	20.68	19.06	.732	.810	.660
Middle Bass, Ohio	3	20.2	1.0868	22.56	23.59	21.78	2.21	2.28	2.14	20.34	21.31	19.57	.595	.630	.570
North Bass, Ohio	12	20.6	1.0887	23.07	25.41	21.49	2.17	2.88	1.84	20.90	22.53	19.35	.646	.886	.518
Sandusky, Ohio	2	19.6	1.0780	20.26	20.83	19.68	2.06	2.10	2.01	18.20	18.73	17.67	.787	.802	.772
Venice, Ohio	5	20.4	1.0871	22.65	23.46	21.49	2.62	2.78	2.27	20.03	21.19	18.73	.874	1.005	.713
Geneva, N. Y.	1	18.1	1.0755	19.60	.....	.....	1.96	.....	.....	17.64	.....	.....	.892	.....	.....
Averages, limits, and totals	29	20.3	1.0865	21.81	25.41	19.60	2.33	2.88	1.84	20.15	22.53	17.64	.716	1.005	.518
CLINTON.															
Dover, Ohio	2	23.3	1.1010	26.31	26.62	25.99	3.40	3.42	3.38	22.91	23.24	22.57	1.184	1.222	1.155
Huron, Ohio	1	21.9	1.0925	24.07	.....	.....	2.99	.....	.....	21.08	.....	.....	1.140	.....	.....
Venice, Ohio	1	24.3	1.1036	26.99	.....	.....	4.39	.....	.....	22.60	.....	.....	1.312	.....	.....
Vermilion, Ohio	1	20.0	1.0857	22.28	.....	.....	3.68	.....	.....	18.60	.....	.....	1.036	.....	.....
Averages, limits, and totals	5	22.6	1.0968	25.19	26.99	22.28	3.57	4.39	2.99	21.62	23.24	18.60	1.173	1.312	1.036
CONCORD.															
Kelleys Island, Ohio	1	17.5	1.0738	19.16	.....	.....	2.00	.....	.....	17.16	.....	.....	.503	.....	.....
Middle Bass, Ohio	3	18.9	1.0794	20.61	21.28	19.86	1.97	2.36	1.76	18.65	18.92	18.10	.420	.420	.420
North Bass, Ohio	2	17.6	1.0728	18.88	19.05	18.71	2.33	2.41	2.24	16.56	16.81	16.30	.668	.735	.600
Put in Bay, Ohio	1	18.5	1.0781	20.28	.....	.....	2.45	.....	.....	17.83	.....	.....	.510	.....	.....
Venice, Ohio	2	19.8	1.0833	21.64	22.86	20.41	2.33	2.47	2.18	19.31	20.39	18.23	.567	.660	.473
Vermilion, Ohio	2	18.0	1.0745	19.34	19.55	19.13	2.38	2.56	2.20	16.96	16.99	16.93	.518	.533	.503
Michigan	1	18.2	1.0756	19.63	.....	.....	2.27	.....	.....	17.36	.....	.....	.578	.....	.....

Brocton, N. Y.	6	19.3	1.0807	20.95	21.31	20.70	2.28	2.55	2.10	18.68	19.05	18.28	.699	.772	.638
Fredonia, N. Y.	6	19.3	1.0727	18.87	19.68	18.40	2.85	3.20	2.29	16.01	16.87	15.44	.662	.750	.518
Geneva, N. Y.	1	18.2	1.0771	20.02	.....	.....	2.30	.....	.....	17.72	.....	.....	.638	.....	.....
Westfield, N. Y.	1	19.9	1.0841	21.86	.....	.....	2.02	.....	.....	19.84	.....	.....	.518	.....	.....
North East, Pa.	8	18.4	1.0753	19.55	21.28	17.69	2.52	3.06	1.71	15.80	18.67	15.07	.643	.735	.420
Averages, limits, and totals	34	18.5	1.0768	19.93	22.86	17.69	2.41	3.20	1.71	17.53	20.39	15.07	.612	.772	.420
DELAWARE.															
Kelleys Island, Ohio	1	22.7	1.0998	25.99	.....	.....	2.61	.....	.....	23.38	.....	.....	.510	.....	.....
Middle Bass, Ohio	6	24.8	1.1080	28.12	29.23	27.01	2.50	3.05	1.98	25.62	26.85	24.34	.519	.548	.503
North Bass, Ohio	2	23.2	1.1006	26.20	26.62	25.78	2.29	2.47	2.10	23.92	24.15	23.68	.676	.683	.668
Sandusky, Ohio	2	23.9	1.1044	27.20	28.25	26.14	2.73	2.92	2.54	24.47	25.33	23.60	.563	.585	.540
Venice, Ohio	2	22.9	1.0993	25.11	25.75	24.46	2.74	2.79	2.68	23.12	24.46	21.78	.582	.600	.563
Vermilion, Ohio	1	20.8	1.0899	23.38	.....	.....	2.30	.....	.....	21.08	.....	.....	.525	.....	.....
Fredonia, N. Y.	2	18.3	1.0767	19.91	20.55	19.26	2.47	2.59	2.35	17.44	17.96	16.91	1.017	1.066	.968
Geneva, N. Y.	1	19.3	1.0824	21.41	.....	.....	2.11	.....	.....	19.30	.....	.....	.713	.....	.....
Averages, limits, and totals	17	22.8	1.0989	25.67	29 23	19.26	2.50	3.05	1.98	23.14	26.85	16.91	.620	1.066	.503
ELVIRA.															
Kelleys Island, Ohio	1	15.3	1.0614	15.92	.....	.....	2.35	.....	.....	13.57	.....	.....	.750	.....	.....
FRANKEN RIESLING.															
Geneva, N. Y.	1	19.5	1.0806	20.94	.....	.....	2.79	.....	.....	18.15	.....	.....	1.208	.....	.....
IONA.															
Brownhelm, Ohio	1	19.4	1.0810	21.04	.....	.....	2.36	.....	.....	18.68	.....	.....	.660	.....	.....
Vermilion, Ohio	1	21.5	1.0302	23.46	.....	.....	1.74	.....	.....	21.72	.....	.....	.630	.....	.....
Geneva, N. Y.	1	19.0	1.0812	21.10	.....	.....	2.10	.....	.....	19.00	.....	.....	.862	.....	.....
Averages, limits, and totals	3	20.0	1.0841	21.87	23.46	21.04	2.07	2.36	1.74	19.80	21.72	18.68	.717	.862	.630
ISABELLA.															
Kelleys Island, Ohio	1	18.1	1.0761	19.76	.....	.....	2.79	.....	.....	16.97	.....	.....	.645	.....	.....
IVES.															
North Bass, Ohio	2	15.1	1.0618	16.01	16.13	15.89	2.33	2.45	2.21	13.68	13.92	13.44	.725	.826	.623
Venice, Ohio	5	16.8	1.0694	18.02	21.04	16.28	2.61	3.23	2.15	15.34	17.52	13.74	.585	.675	.525
Vermilion, Ohio	1	15.5	1.0628	16.28	.....	.....	2.38	.....	.....	13.90	.....	.....	.495	.....	.....
Averages, limits, and totals	8	16.2	1.0667	17.30	21.04	15.89	2.64	3.23	2.15	14.75	17.52	13.44	.609	.826	.495
JESSICA.															
Kelleys Island, Ohio	1	19.9	1.0851	22.12	.....	.....	2.42	.....	.....	19.70	.....	.....	.450	.....	.....

TABLE 1.—*Composition of American native grapes; average, maximum, and minimum data*—Continued.

SAMPLES FROM OHIO, NEW YORK, AND PENNSYLVANIA, 1911; EXAMINED AT SANDUSKY, OHIO; EOFF AND SHERWOOD, ANALYSTS—Contd.

Variety and locality.	Number of samples.	Brix.	Average specific gravity.	Total solids.			Sugar-free solids.			Sugar as invert.			Acid as tartaric.		
				Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.
MISSOURI RIESLING.															
Kelleys Island, Ohio	1	18.7	1.0778	20.20	.....	.....	2.48	.....	.....	17.72	.....	.....	0.668	.....	.....
Geneva, N. Y.	1	17.5	1.0733	19.03	.....	.....	2.36	.....	.....	16.67	.....	.....	.803	.....	.....
Averages, limits, and totals	2	18.1	1.0756	19.62	20.20	19.03	2.42	2.48	2.36	17.20	17.72	16.67	.736	0.803	0.668
MOLITOR.															
Middle Bass, Ohio	1	.....	1.0942	24.51	.....	.....	4.15	.....	.....	20.36	.....	.....	1.006	.....	.....
MONTEFIORE.															
Kelleys Island, Ohio	1	.....	1.0911	23.70	.....	.....	3.40	.....	.....	20.30	.....	.....	.645	.....	.....
Geneva, N. Y.	1	15.1	1.0626	16.23	.....	.....	1.90	.....	.....	14.33	.....	.....	.510	.....	.....
Averages, limits, and totals	2	15.1	1.0769	19.97	23.70	16.23	2.65	3.40	1.90	17.32	20.30	14.33	.578	.645	.510
NIAGARA.															
North Bass, Ohio	1	15.7	1.0651	16.88	.....	.....	2.61	.....	.....	14.27	.....	.....	.570	.....	.....
NORTON.															
Kelleys Island, Ohio	1	23.2	1.0998	25.99	.....	.....	3.93	.....	.....	22.06	.....	.....	1.642	.....	.....
Sandusky, Ohio	2	22.7	1.0978	25.45	25.72	25.17	3.46	3.46	3.45	21.99	22.26	21.72	1.037	1.065	.998
Venice, Ohio	1	24.2	1.1062	27.67	.....	.....	4.50	.....	.....	23.17	.....	.....	1.343	.....	.....
Geneva, N. Y.	1	22.5	1.0928	24.14	.....	.....	3.93	.....	.....	20.21	.....	.....	2.212	.....	.....
Averages, limits, and totals	5	23.1	1.0989	25.94	27.67	24.14	3.66	4.50	3.45	21.88	23.17	20.21	1.452	2.212	.998
SCHRAIDT.															
North Bass, Ohio	3	20.7	1.0875	22.74	23.38	22.28	3.90	4.19	3.49	18.85	19.37	18.09	1.600	1.672	1.546
SEIBEL NO. 2.															
Geneva, N. Y.	1	13.6	1.0553	14.33	.....	.....	3.23	.....	.....	11.10	.....	.....	1.852	.....	.....

TRIUMPH.															
Geneva, N. Y.	1	12.7	1.0514	13.31	.....	.....	2.22	.....	.....	11.09	.....	.....	1.012	.....	.....
WORDEN.															
Fredonia, N. Y.	2	14.5	1.0589	15.27	15.55	14.98	2.31	2.34	2.28	13.12	13.46	12.77	.922	.952	.892

SAMPLES FROM CHARLOTTESVILLE, VA., 1911; HARTMANN, ANALYST.

CONCORD.															
Charlottesville, Va.	3	.....	1.0792	20.58	21.48	19.40	2.47	3.14	2.04	18.11	18.62	17.36	0.530	0.533	0.525
CYNTHIANA.															
Charlottesville, Va.	2	22.6	1.0955	24.95	24.96	24.93	3.72	4.16	3.27	21.23	21.66	20.80	.787	.780	.754
DELAWARE.															
Charlottesville, Va.	1	25.1	1.1084	28.24	.....	.....	2.44	.....	.....	25.80	.....	.....	.645	.....	.....
IVES.															
Charlottesville, Va.	1	18.0	1.0751	19.50	.....	.....	3.60	.....	.....	15.90	.....	.....	.750	.....	.....
NIAGARA.															
Charlottesville, Va.	1	14.6	1.0610	15.82	.....	.....	2.26	.....	.....	13.14	.....	.....	.810	.....	.....
NOAH.															
Charlottesville, Va.	1	21.0	1.0883	22.96	.....	.....	2.71	.....	.....	20.25	.....	.....	7.50	.....	.....
NORTON.															
Charlottesville, Va.	7	22.8	1.0968	25.23	26.59	23.46	3.74	3.94	3.64	21.49	22.90	19.82	.867	.990	.743
UNKNOWN.															
Charlottesville, Va.	2	20.3	1.0840	21.82	22.52	21.12	2.26	2.42	2.10	19.56	20.42	18.70	.735	.735	.735

TABLE 1.—*Composition of American native grapes; average, maximum, and minimum data*—Continued.

SAMPLES FROM NEW JERSEY, 1913; ALWOOD, CARRERO, AND HARDING, ANALYSTS.

Variety and locality.	Number of samples.	Brix.	Average specific gravity.	Total solids.			Sugar-free solids.			Sugar as invert.			Acid as tartaric.		
				Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.
BRILLIANT.															
Vineland, N. J.	1	.....	1.0882	22.93	.....	.....	4.22	.....	.....	18.71	.....	.....	0.676	.....	.....
CANADA.															
Vineland, N. J.	1	.....	1.0705	18.30	.....	.....	3.70	.....	.....	14.60	.....	.....	1.028	.....	.....
CAMPBELL'S EARLY.															
Vineland, N. J.	1	.....	1.0721	18.71	.....	.....	3.81	.....	.....	14.90	.....	.....	.540	.....	.....
CATAWBA.															
Vineland, N. J.	1	.....	1.0767	19.92	.....	.....	3.69	.....	.....	16.23	.....	.....	1.042	.....	.....
CLEVENER.															
Egg Harbor, N. J.	1	.....	1.0617	16.00	.....	.....	3.94	.....	.....	12.06	.....	.....	1.425	.....	.....
Germania, N. J.	1	.....	1.0700	16.16	.....	.....	4.78	.....	.....	13.38	.....	.....	1.328	.....	.....
Vineland, N. J.	1	.....	1.0766	19.89	.....	.....	4.20	.....	.....	15.69	.....	.....	1.102	.....	.....
Averages, limits, and totals.	3	.....	1.0694	18.02	19.89	16.00	4.31	4.78	3.94	13.68	15.69	12.06	1.285	1.425	1.102
CLINTON.															
Egg Harbor, N. J.	1	.....	1.0770	20.00	.....	.....	3.44	.....	.....	16.56	.....	.....	1.729	.....	.....
Germania, N. J.	1	.....	1.0909	23.65	.....	.....	3.38	.....	.....	20.27	.....	.....	1.666	.....	.....
Vineland, N. J.	1	.....	1.0810	21.04	.....	.....	3.95	.....	.....	17.09	.....	.....	1.800	.....	.....
Averages, limits, and totals.	3	.....	1.0830	21.56	23.65	20.00	3.59	3.95	3.38	17.94	20.27	16.56	1.732	1.800	1.666
CONCORD.															
Egg Harbor, N. J.	1	.....	1.0617	16.00	.....	.....	1.68	.....	.....	14.32	.....	.....	.619	.....	.....
Germania, N. J.	1	.....	1.0672	17.43	.....	.....	3.40	.....	.....	14.03	.....	.....	.758	.....	.....
Vineland, N. J.	1	.....	1.0682	17.69	.....	.....	3.80	.....	.....	13.89	.....	.....	.818	.....	.....
Averages, limits, and totals.	3	.....	1.0657	17.04	17.69	16.00	2.96	3.80	1.68	14.08	14.32	13.89	.732	.818	.619

CONQUEROR.																
Germania, N. J.	1		1.0634	16.44			3.82			12.62			1.132			
Egg Harbor, N. J.	1		1.0632	16.39			3.16			13.23			1.016			
Averages, limits, and totals	2		1.0633	16.42	16.44	16.39	3.49	3.82	3.16	12.98	13.23	12.62	1.074	1.132	1.016	
CYNTHIANA.																
Germania, N. J.	1		1.0870	22.62			4.88			17.74			1.350			
Vineland, N. J.	1		1.0998	25.99			5.35			20.64			1.182			
Averages, limits, and totals	2		1.0934	24.31	25.99	22.62	5.12	5.35	4.88	19.24	20.64	17.74	1.266	1.350	1.182	
DELAWARE.																
Vineland, N. J.	1		1.1023	26.64			4.25			22.39			.660			
DIOGENES.																
Egg Harbor, N. J.	2		1.0757	19.66	20.70	18.61	4.46	5.23	3.69	15.20	15.47	14.92	1.548	1.549	1.546	
Germania, N. J.	1		1.0651	16.88			4.58			12.30			1.702			
Averages, limits, and totals	3		1.0722	18.73	20.70	16.88	4.50	5.23	3.69	14.23	15.47	12.30	1.599	1.702	1.546	
DUTCHESS.																
Vineland, N. J.	1		1.0804	20.89			4.11			16.78			.586			
EUMELAN.																
Vineland, N. J.	1		1.0865	22.49			4.11			18.38			.706			
FRANKLIN.																
Vineland, N. J.	1		1.0914	23.77			5.36			18.41			1.188			
GOETHE.																
Vineland, N. J.	1		1.0691	17.93			2.81			15.12			.888			
HERBEMONT.																
Vineland, N. J.	1		1.0735	19.08			3.53			15.55			.904			
IVES.																
Egg Harbor, N. J.	3		[1] 1.0631	[1] 16.35	16.91	15.79	[1] 2.76	3.25	2.27	13.52	14.64	12.54	.724	.735	.713	
Germania, N. J.	1		1.0661	17.14			3.88			13.26			.706			
Hammonton, N. J.	4		1.0633	16.40	17.22	15.48	2.96	3.17	2.75	13.44	14.47	12.49	.870	.930	.832	
Vineland, N. J.	4		1.0713	18.50	20.26	16.10	4.09	4.37	3.80	14.42	16.07	12.32	.578	.630	.464	
Averages, limits, and totals	12		[2] 1.0664	[2] 17.22	20.26	15.48	[2] 3.41	4.37	2.27	13.77	16.07	12.32	.723	.930	.464	

[1] 2 samples analyzed.

[2] 11 samples analyzed.

TABLE 1.—*Composition of American native grapes; average, maximum, and minimum data*—Continued.

SAMPLES FROM NEW JERSEY, 1913; ALWOOD, CARRERO, AND HARDING, ANALYSTS—Continued.

Variety and locality.	Number of samples.	Brix.	Average specific gravity.	Total solids.			Sugar-free solids.			Sugar as invert.			Acid as tartaric.		
				Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.
JEFFERSON.															
Vineland, N. J.	1		1.0816	21.20			3.75			17.45			0.886		
LENOIR.															
Vineland, N. J.	1		1.0730	18.95			4.05			14.90			1.546		
LINDLEY.															
Vineland, N. J.	1		1.0766	19.89			2.97			16.92			.704		
MOORE DIAMOND.															
Egg Harbor, N. J.	1		1.0779	20.23			2.75			17.48			.634		
NOAH.															
Egg Harbor, N. J.	1		1.0658	17.07			4.20			12.87			1.372		
Vineland, N. J.	2		1.0841	21.85	22.88	20.81	3.59	3.93	3.25	18.26	18.95	17.56	.962	1.084	0.840
Averages, limits, and totals.	3		1.0780	20.25	22.88	17.07	3.79	4.20	3.25	16.46	18.95	12.87	1.099	1.372	.840
NORTON.															
Egg Harbor, N. J.	2		1.0816	21.19	22.17	20.20	4.91	5.39	4.43	16.28	17.74	14.81	1.483	1.598	1.368
Vineland, N. J.	1		1.0937	24.38			3.94			20.44			1.204		
Averages, limits, and totals.	3		1.0856	22.25	24.38	20.20	4.59	5.39	3.91	17.67	20.44	14.81	1.390	1.598	1.204
MISSOURI RIESLING.															
Vineland, N. J.	1		1.0805	20.91			3.61			17.30			.886		
SALEM.															
Vineland, N. J.	1		1.0846	21.99			4.58			17.41			1.085		
TAYLOR.															
Egg Harbor, N. J.	1		1.0855	22.22			3.14			19.08			1.106		
Germania, N. J.	1		1.0790	20.52			4.46			16.06			1.546		
Averages, limits, and totals.	2		1.0823	21.37	22.22	20.52	3.80	4.46	3.14	17.57	19.08	16.06	1.326	1.546	1.106

ULSTER.															
Vineland, N. J.	1		1.0885	23.01			3.78			19.23			.684		
WINCHELL.															
Egg Harbor, N. J.	1		1.0855	22.22			2.94			19.28			.506		
WOODRUFF.															
Vineland, N. J.	1		1.0709	18.40			4.86			13.54			.660		

SAMPLES FROM KEUKA DISTRICT, 1913; ALWOOD AND HARDING, ANALYSTS.

AGAWAM.															
Hammondsport, N. Y.	1		1.0775	20.12			1.92			18.20			0.856		
Pulteney, N. Y.	2		1.0859	22.33	22.80	21.86	3.14	3.30	2.98	19.19	19.82	18.56	1.016	1.080	0.952
Urbana, N. Y.	1		1.0846	21.99			2.51			19.48			.528		
Averages, limits, and totals.	4		1.0835	21.69	22.80	20.12	2.68	3.30	1.92	19.02	19.82	18.20	.854	1.080	.528
CATAWBA.															
Dundee, N. Y.	2		1.0891	23.17	23.41	22.93	3.41	3.57	3.25	19.76	19.84	16.86	1.320	1.328	1.312
Grove Springs, N. Y.	1		1.0923	24.01			3.61			20.40			1.200		
Hammondsport, N. Y.	14		1.0772	21.35	24.59	18.16	2.79	3.40	1.73	18.56	21.48	15.37	1.247	1.672	.862
Naples, N. Y.	2		1.0737	19.13	19.18	19.08	2.92	3.43	2.41	16.21	16.67	15.75	1.523	1.786	1.260
Penn Yan, N. Y.	1		1.0868	22.57			3.01			19.56			1.200		
Pulteney, N. Y.	5		1.0858	22.24	23.17	20.81	3.24	3.79	2.65	19.00	20.18	18.16	1.284	1.410	1.156
Averages, limits, and totals.	25		1.0833	21.65	24.59	18.16	2.98	3.79	1.73	18.67	21.84	15.37	1.270	1.786	.862
CONCORD.															
Dundee, N. Y.	2		1.0848	22.04	22.09	21.99	2.49	3.25	1.73	19.55	20.26	18.84	.708	.712	.704
Hammondsport, N. Y.	20		1.0754	19.58	24.25	14.33	2.85	5.47	2.01	16.74	19.28	12.03	.853	1.456	.660
Keuka, N. Y.	1		1.0837	21.75			2.61			19.14			.584		
Naples, N. Y.	2		1.0729	18.91	19.89	17.93	2.36	2.55	2.16	16.56	17.34	15.77	.758	.758	.758
Penn Yan, N. Y.	1		1.0891	23.17			2.29			20.88			.488		
Pulteney, N. Y.	2		1.0737	19.13	19.65	18.61	2.33	2.63	2.03	16.80	17.02	16.58	.722	.780	.664
Averages, limits, and totals.	28		1.0766	19.88	24.25	14.33	2.72	5.47	1.73	17.16	20.80	12.03	.804	1.456	.488
CLINTON.															
Hammondsport, N. Y.	11		[1] 1.0983	[1] 24.58	27.78	22.09	[1] 4.07	4.52	3.48	21.43	23.48	20.34	1.858	2.482	.930
Naples, N. Y.	1		1.0864	22.46			4.12			18.34			2.558		
Pulteney, N. Y.	1		1.0570	[2] 14.77			3.25			11.52			2.250		
Averages, limits, and totals.	13		[3] 1.0938	23.58	27.78	14.77	[3] 4.01	4.52	3.25	20.43	23.48	11.52	1.942	2.558	.930

[1] Only 10 determinations made.

[2] Foliage destroyed.

[3] Average of 12 determinations.

TABLE 1.—*Composition of American native grapes; average, maximum, and minimum data*—Continued.

SAMPLES FROM KEUKA DISTRICT, 1913; ALWOOD AND HARDING, ANALYSTS—Continued.

Variety and locality.	Number of samples.	Brix.	Average specific gravity.	Total solids.			Sugar-free solids.			Sugar as invert.			Acid as tartaric.		
				Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.
WHITE CLINTON.															
Hammondsport, N. Y.	1	.....	1.0986	25.67	.....	.....	3.89	.....	.....	21.78	.....	.....	1.298	.....	.....
DELAWARE.															
Hammondsport, N. Y.	3	.....	1.0944	24.52	25.43	23.04	2.78	2.90	2.68	21.78	22.68	20.14	.958	1.028	0.856
Naples, N. Y.	1	.....	1.0973	25.33	.....	.....	2.69	.....	.....	22.64	.....	.....	.728	.....	.....
Urbana, N. Y.	1	.....	1.0982	25.56	.....	.....	3.10	.....	.....	22.46	.....	.....	.952	.....	.....
	1	.....	1.0927	24.12	.....	.....	2.56	.....	.....	21.56	.....	.....	1.102	.....	.....
Averages, limits, and totals	6	.....	1.0952	24.76	25.56	23.04	2.78	3.10	2.56	22.00	22.68	20.14	.943	1.102	.728
DIANA.															
Hammondsport, N. Y.	5	.....	1.0861	22.39	23.41	20.57	3.78	4.28	3.27	18.61	19.60	17.30	.994	1.118	.922
Pulteney, N. Y.	1	.....	1.0855	22.22	.....	.....	2.46	.....	.....	19.76	.....	.....	.946	.....	.....
Averages, limits, and totals	6	.....	1.0860	22.36	23.41	20.57	3.56	4.28	2.46	18.80	19.76	17.30	.986	1.118	.922
DUTCHESS.															
Naples, N. Y.	1	.....	1.0766	19.89	.....	.....	1.87	.....	.....	18.02	.....	.....	.704	.....	.....
ELVIRA.															
Urbana, N. Y.	4	.....	1.0634	17.09	18.78	15.79	2.86	3.35	2.60	14.16	15.12	13.19	1.288	1.402	1.230
IONA.															
Hammondsport, N. Y.	3	.....	1.0841	21.87	22.80	20.81	3.02	3.85	2.41	18.87	20.06	16.96	1.238	1.426	1.118
ISABELLA.															
Dundee, N. Y.	1	.....	1.0828	21.52	.....	.....	3.18	.....	.....	18.34	.....	.....	1.012	.....	.....
Hammondsport, N. Y.	6	.....	1.0725	18.82	21.86	16.23	2.45	2.93	1.99	16.38	19.34	14.15	1.247	1.658	.960
Naples, N. Y.	2	.....	1.0564	14.60	15.89	13.31	2.29	2.47	2.11	12.31	13.78	10.84	1.282	1.432	1.132
Averages, limits, and totals	9	.....	1.0701	18.16	21.86	13.31	2.49	3.18	1.99	15.69	19 34	10.84	1.228	1.658	.960

IVES.															
Hammondsport, N. Y.	2	.....	1.0713	18.56	19.08	17.93	2.57	2.68	2.45	15.94	16.40	15.48	.882	.916	.848
Naples N. Y.	1	.....	1.0548	14.20	.....	.....	2.97	.....	.....	11.23	.....	.....	.766	.....	.....
Averages, limits, and totals	3	.....	1.0658	17.07	19.08	14.20	2.70	2.97	2.45	14.37	16.40	11.23	.843	.916	.766
LINDLEY.															
Pulteney, N. Y.	1	.....	1.0801	20.81	.....	.....	2.27	.....	.....	18.54	.....	.....	.720	.....	.....
MAXFIELD.															
Naples, N. Y.	1	.....	1.0722	18.74	.....	.....	2.87	.....	.....	15.87	.....	.....	.796	.....	.....
NIAGARA.															
Dundee, N. Y.	1	.....	1.0783	20.34	.....	.....	3.84	.....	.....	16.50	.....	.....	.714	.....	.....
Hammondsport, N. Y.	2	.....	1.0744	19.30	19.42	19.18	3.17	3.84	2.50	16.13	16.92	15.34	.645	.712	.578
Penn Yan, N. Y.	1	.....	1.0859	22.33	.....	.....	3.21	.....	.....	19.12	.....	.....	.614	.....	.....
Pulteney, N. Y.	2	.....	1.0632	16.39	17.12	15.66	2.54	2.56	2.51	13.86	14.56	13.15	.543	.562	.524
Averages, limits, and totals	6	.....	1.0732	19.01	22.33	15.66	3.08	3.84	2.50	15.96	19.12	13.15	.617	.714	.524
PRENTISS.															
Pulteney, N. Y.	1	.....	1.0739	19.18	.....	.....	1.71	.....	.....	17.47	.....	.....	.728	.....	.....
SALEM.															
Hammondsport, N. Y.	1	.....	1.0837	21.75	.....	.....	3.31	.....	.....	18.44	.....	.....	1.088	.....	.....
Naples, N. Y.	1	.....	1.0923	24.01	.....	.....	3.17	.....	.....	20.84	.....	.....	.720	.....	.....
Averages, limits, and totals	2	.....	1.0880	22.88	24.01	21.75	3.24	3.31	3.17	19.64	20.84	18.44	.904	1.088	.720

SAMPLES FROM CHAUTAUQUA DISTRICT, 1913; ALWOOD AND HARDING, ANALYSTS.

CONCORD.															
Dunkirk, N. Y.	2	.....	1.0764	19.83	20.70	18.95	1.42	1.78	1.05	18.41	18.92	17.90	0.652	0.674	0.630
Fredonia, N. Y.	25	.....	1.0773	20.07	21.99	15.89	2.21	3.34	1.20	17.87	20.44	13.68	.701	.856	.554
Leona, N. Y.	1	.....	1.0779	20.23	.....	.....	2.75	.....	.....	17.48	.....	.....	.734	.....	.....
Sheridan, N. Y.	6	.....	1.0590	19.65	21.62	17.69	2.68	3.40	1.82	17.17	19.00	15.86	.707	.766	.644
Averages, limits, and totals	34	.....	1.0740	19.99	22.80	15.89	2.23	3.40	1.05	18.36	20.44	13.68	.700	.856	.554
Composite, analyzed Oct. 8	8	.....	1.0726	18.84	.....	.....	1.57	.....	.....	17.27	.....	.....	.713	.....	.....
Composite, analyzed Oct. 10	8	.....	1.0775	20.12	.....	.....	1.48	.....	.....	18.64	.....	.....	.712	.....	.....
Composite, analyzed Oct. 14	8	.....	1.0801	20.81	.....	.....	1.81	.....	.....	19.00	.....	.....	.682	.....	.....
Composite, analyzed Oct. 16	8	.....	1.0779	20.23	.....	.....	2.29	.....	.....	17.94	.....	.....	.674	.....	.....
Composite, analyzed Oct. 17	8	.....	1.0775	20.12	.....	.....	2.50	.....	.....	17.62	.....	.....	.728	.....	.....
Composite, analyzed Oct. 21	8	.....	1.0691	17.93	.....	.....	2.34	.....	.....	15.59	.....	.....	.766	.....	.....
Averages, limits, and totals	48	.....	1.0758	19.68	20.81	17.93	2.00	2.50	1.48	17.66	19.00	15.59	.713	.766	.674

TABLE 2.—*Composition of muscadine grapes grown in North Carolina, 1913; Alwood and Carrero, analysts.*

[Results stated in grams per 100 cc of expressed juice.]

Variety and locality.	Number of samples.	Average specific gravity.	Total solids.			Sugar-free solids.			Sugar as reducing.			Sucrose.			Total sugar as invert.			Acid as tartaric.		
			Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.	Average.	Maximum.	Minimum.
EDEN.																				
Willard, N. C.	3	1.0506	13.10	14.93	10.82	2.02	2.58	1.69	11.08	13.24	8.24							1.137	1.678	0.818
FLOWERS.																				
Willard, N. C.	2	1.0445	11.51	12.25	10.76	2.36	2.59	2.12	9.15	10.13	8.17							1.264	1.388	1.140
JAMES.																				
Willard, N. C.	3	1.0492	12.73	14.74	11.49	1.98	3.07	1.30	10.75	13.18	8.42							.691	.908	.534
LUOLA.																				
Willard, N. C.	1	1.0536	13.89			1.41			12.48									.630		
MISH.																				
Enfield, N. C.	1	1.0579	15.00			4.29			10.71									.624		
Fayetteville, N. C.	1	1.0513	13.29			4.23			9.06									.736		
Averages, limits, and totals	2	1.0556	14.15	15.00	13.29	4.26	4.29	4.23	9.89	10.71	9.06							.680	.736	.624
SCUPPERNONG.																				
Chinquapin, N. C.	4	1.0558	14.47	14.45	13.49	1.66	1.70	1.60	11.44	12.27	10.60	1.37	1.64	1.13	12.88	13.85	11.86	.698	.772	.578
Jacksonville, N. C.	3	1.0508	13.16	14.43	11.70	1.18	1.61	.71	10.71	11.80	9.62	1.27	1.95	.47	12.04	13.26	10.11	.713	.766	.660
Willard, N. C.	3	1.0569	14.75	16.07	13.89	1.91	2.79	1.27	12.10	13.37	11.10	[1] 1.12	1.21	1.03	[1] 13.76	14.45	13.06	.863	.952	.818
Averages, limits, and totals.	10	1.0547	14.16	16.07	11.70	1.59	2.79	.71	11.42	13.37	9.62	[2] 1.28	1.95	.47	[2] 12.80	14.45	10.11	.752	.952	.579
SMITH.																				
Willard, N. C.	2	1.0552	14.29	14.77	13.81	1.61	1.81	1.20	12.69	13.37	12.00							.839	.906	.772
THOMAS.																				
Willard, N. C.	2	1.0598	15.49	16.10	14.87	4.94	5.31	4.56	10.55	11.54	9.56							.800	.833	.766

[1] Two samples analyzed.

[2] Nine samples analyzed.

DISCUSSION OF ANALYTICAL RESULTS.

1911 SAMPLES.

The remarkably high quality of the samples of the standard varieties collected in 1911, examined at Sandusky and Charlottesville, is worthy of emphasis, because of the statement so frequently made in the past that our native grapes are unfit for wines or other by-products without a large addition of sugar or sugar solution. It may be noted that 28 samples of Catawba from the northern Ohio district average 20.24 grams of sugar and 0.709 gram of acid in 100 cc, or an acid-sugar ratio of 1 to 28.6. Such fruit properly handled does not require any amelioration for unfermented juice or for wine. In this connection it is important to note that this is the lowest acid content found for Catawba but not the highest sugar content. The crop of 1911 was exceptionally well balanced as to the ratio of acid and sugar content in most varieties.

Clinton for five samples examined shows 21.62 grams of sugar and 1.173 grams of acid in 100 cc, or an acid-sugar ratio of 1 to 18.4. This is the highest sugar content recorded for Clinton, and also the widest acid-sugar ratio.

The Concord samples show remarkable acid-sugar ratios. For both northern Ohio and Virginia samples this is about 1 to 34, and 23 Concord samples collected from other northern points outside of Ohio show an acid-sugar ratio of 1 to 25.9.

Cynthiana and Norton are similar varieties in appearance, growth, and general character of fruit but show differences in composition which are quite important. Cynthiana in Virginia gives 21.23 grams of sugar and 0.767 gram of acid in 100 cc, or an acid-sugar ratio of 1 to 27.7, while Norton, with 21.49 grams of sugar and 0.867 gram of acid in 100 cc of juice, shows an acid-sugar ratio of 1 to 24.8. From the well-known character of the juice of these grapes, and the large precipitation of cream of tartar which will occur with correct treatment, the acid content is rather low for producing a pleasant, sprightly food product.

1913 SAMPLES.

The samples collected in North Carolina were of varieties of the *Vitis rotundifolia* species commonly called muscadine grapes. Since these are grown quite extensively for the manufacture of wine, it was desirable to obtain information as to their composition. Their acid content is in most cases favorable to wine making. Ten samples were examined for sucrose with the result that this form of sugar was found in appreciable quantity. The results here given are on the expressed juice.

The New Jersey samples introduce a few names not heretofore recorded in this work. None of the samples from this district show a high sugar content; in fact they are mostly low in sugar when

compared with other districts. Such little-grown varieties as Clevener and Diogenes give a juice of very deep color and are desired for blending in making red wines. The grape-growing districts of New Jersey need further attention before it will be possible to draw conclusions of value on the quality of the crop.

SUMMARY OF DATA ON SUGAR AND ACID FOR FIVE YEARS.

Table 3 brings together the results for sugar and acid determinations of all the varieties, with a few exceptions, examined during the five years' work, 1908, 1909, 1910, 1911, and 1913. The exceptions are the muscadine varieties and a number of unnamed and undisseminated seedlings. When more than one sample was analyzed the average is given. The data from which this table is compiled are the same as given in the tables of Bureau of Chemistry Bulletin 145, pages 20 to 35, and in Table 1 of this bulletin. So far as possible the results are grouped by districts for those kinds of grapes of which a considerable number of samples have been examined from several districts. The following groups are used: "Northern Ohio" includes the vineyards along the shore of Lake Erie and the islands off Sandusky; "New York" includes the Geneva, Keuka, and Chautauqua districts; other northern districts, from which samples did not distinctly represent any one district, are given as "Other Northern," and if for the reason that only a few widely-scattered samples of a variety were collected no division is made into districts the samples are given as from "All Northern." Southern samples were taken from restricted areas and are so grouped.

The summary presented in Table 3 covering the five-year period shows some interesting comparisons on samples which were taken with care and in sufficient number to warrant the belief that they represent the facts. For instance, Catawba for northern Ohio, one of the rather strongly-acid fruits, shows a very narrow range of average sugar for the several years, from 18.05 grams to 20.78 grams in 100 cc of juice during four years, but with a variation of acid from 0.709 gram to 1.155 grams in 100 cc or in acid-sugar ratios a variation from 1 to 15.6 to 1 to 28.6.

Take also the example of Concord, one of the varieties of medium content of sugar and moderately low in acid. Here again the range in sugar content is slight, being from 15.74 grams to 18.51 grams in 100 cc with an acid range from 0.466 gram to 0.757 gram in 100 cc. This gives acid-sugar ratios running from 1 to 22.4 to 1 to 37.3.

Delaware shows the most phenomenal acid-sugar ratio of any variety examined. Comparing only the northern Ohio samples for 1909, 1910, and 1911, because these are the more representative, the ratios extend from 1 to 26.0 to 1 to 43.8. Certainly the latter ratio is entirely too wide for a properly balanced grape juice or for a dry wine. Such low acidity endangers the keeping quality of the products.

A high or low acid-sugar ratio itself carries no index of richness or food quality. It is simply a statement of the balance between these elements compared with each other and indicates agreeableness or lack of agreeableness to the palate. A rich juice may be quite acid in its fresh state, as for instance, Norton for northern Ohio, 1911, which is indeed a rich juice but with an acid-sugar ratio of 1 to 17.8, entirely too narrow for a potable juice in the fresh state. The indications are that the amelioration of such a juice by proper factory technic is possible.

TABLE 3.—*Comparison of total sugar and acid results for all named varieties analyzed during 1908–1911 and 1913, with acid-sugar ratios.*

[Results stated in grams per 100 cc of expressed juice.]

Variety.	Year.	District.	Number of samples.	Sugar as invert.	Acid as tartaric.	Acid-sugar ratio.
Adirondac	1910	All northern	1	10.19	0.911	1:11.2
Agawam	1909	do	2	17.90	.840	1:21.3
Do	1910	New York	3	15.28	1.344	1:11.4
Do	1913	do	4	19.02	.854	1:22.3
Amber Queen	1910	do	1	16.02	1.436	1:11.2
America	1910	do	1	16.94	1.436	1:11.8
Aminia	1910	do	1	16.68	.821	1:20.3
Bacchus	1908	Northern Ohio	2	20.51	1.205	1:17.0
Do	1909	All northern	7	19.64	1.852	1:10.6
Do	1910	Northern Ohio	2	17.42	1.770	1: 9.8
Do	1911	All northern	3	18.34	1.347	1:13.6
Barry	1910	New York	1	12.12	1.159	1:10.5
Belle	1910	do	1	18.78	1.114	1:16.9
Big Extra	1910	do	1	13.91	1.466	1: 9.5
Black Eagle	1910	do	2	17.57	1.011	1:17.4
Brighton	1909	Northern Ohio	2	20.47	.632	1:32.4
Do	1910	All northern	7	18.67	.822	1:21.2
Brilliant	1913	New Jersey	1	18.71	.676	1:27.7
Brown	1910	New York	1	13.64	1.106	1:12.3
Butler No. 1	1910	do	1	17.03	.833	1:20.4
Campbell Early	1909	Northern Ohio	1	13.61	.784	1:17.4
Do	1910	All northern	4	15.56	.884	1:17.9
Do	1913	New Jersey	1	14.90	.540	1:27.6
Canada	1913	do	1	14.60	1.028	1:14.2
Carman	1910	New York	1	13.29	1.654	1: 8.0
Catawba	1908	Northern Ohio	25	20.45	.775	1:26.4
Do	1909	do	84	18.05	1.155	1:15.6
Do	1909	Other northern	7	16.22	[1] 1.552	1:10.4
Do	1910	Northern Ohio	84	20.78	1.071	1:19.4
Do	1910	Other northern	9	18.76	1.431	1:13.1
Do	1911	Northern Ohio	28	20.24	.709	1:28.6
Do	1911	Other northern	1	17.64	.892	1:19.8
Do	1913	New York	25	18.67	1.270	1:14.7
Do	1913	New Jersey	1	16.23	1.042	1:15.6
Champion	1910	New York	1	11.90	.915	1:13.0
Chautauqua	1910	do	1	13.50	1.043	1:12.9
Clevener	1910	do	1	14.96	1.196	1:12.5
Do	1913	New Jersey	3	13.68	1.285	1:10.6
Clinton	1908	Northern Ohio	5	19.28	1.081	1:17.8
Do	1909	do	13	17.73	1.686	1:10.5
Do	1909	Other northern	4	18.69	2.061	1: 9.1
Do	1910	Northern Ohio	3	20.80	1.918	1:10.8
Do	1910	Other northern	4	19.03	2.130	1: 8.9
Do	1911	Northern Ohio	5	21.62	1.173	1:18.4
Do	1913	New York	13	20.43	1.942	1:10.5
Do	1913	New Jersey	3	17.94	1.732	1:10.4
Cloeta	1910	New York	1	16.02	1.088	1:14.7
Colerain	1910	do	1	12.76	.870	1:14.7
Concord	1908	Northern Ohio	11	17.40	.466	1:37.3
Do	1909	do	46	15.74	[2] .702	1:22.4
Do	1909	Other northern	30	15.92	[3] .804	1:19.8
Do	1909	Virginia	14	16.01	.744	1:21.5
Do	1910	Northern Ohio	30	18.51	.757	1:24.4

[1] Acid average of 6 samples. [2] Acid average of 41 samples. [3] Acid average of 29 samples.

TABLE 3.—*Comparison of total sugar and acid results for all named varieties analyzed during 1908–1911 and 1913, with acid-sugar ratios*—Continued.

Variety.	Year.	District.	Number of samples.	Sugar as invert.	Acid as tartaric.	Acid-sugar ratio.
Concord	1910	Other northern	58	16.45	0.888	1:18.5
Do	1910	Virginia	12	16.33	.823	1:19.8
Do	1911	Northern Ohio	11	17.87	.525	1:34.0
Do	1911	Other northern	23	16.93	.654	1:25.9
Do	1911	Virginia	3	18.11	.530	1:34.2
Do	1913	New York	62	17.49	.747	1:23.4
Do	1913	New Jersey	3	14.08	.732	1:19.2
Conqueror	1913	do	2	12.98	1.074	1:12.1
Corby	1910	New York	1	13.77	.938	1:14.7
Creveling	1910	do	1	13.93	1.009	1:13.8
Croton	1910	do	1	11.84	.788	1:15.0
Cynthiana	1909	Northern Ohio	1	19.10	1.598	1:12.0
Do	1909	Virginia	1	19.75	.986	1:20.0
Do	1910	do	1	21.10	1.080	1:19.5
Do	1911	do	2	21.23	.767	1:27.7
Do	1913	New Jersey	2	19.24	1.266	1:15.2
Daisy	1910	New York	1	16.95	.653	1:26.0
Delago	1910	do	1	17.25	1.009	1:17.1
Delaware	1908	Northern Ohio	2	25.24	.467	1:54.1
Do	1909	do	22	21.08	[1].809	1:26.0
Do	1909	Other northern	14	19.86	.853	1:22.9
Do	1909	Virginia	2	22.45	.702	1:32.0
Do	1910	Northern Ohio	11	24.09	.794	1:30.3
Do	1910	Other northern	18	19.70	1.001	1:19.7
Do	1910	Virginia	1	21.00	.551	1:38.1
Do	1911	Northern Ohio	14	24.37	.556	1:43.8
Do	1911	New York	3	18.06	.916	1:19.7
Do	1911	Virginia	1	25.80	.645	1:40.0
Do	1913	New York	6	22.00	.943	1:23.3
Do	1913	New Jersey	1	22.39	.660	1:33.9
Diamond	1910	New York	2	16.52	1.058	1:15.6
Do	1913	New Jersey	1	17.48	.634	1:24.4
Diana	1909	Northern Ohio	1	19.90	.950	1:20.7
Do	1910	All northern	4	20.27	.965	1:21.0
Do	1913	New York	6	18.80	.986	1:19.1
Diogenes	1913	New Jersey	3	14.23	1.599	1: 8.9
Dutchess	1910	New York	3	17.48	.734	1:23.8
Do	1913	do	1	18.02	.704	1:25.6
Do	1913	New Jersey	1	16.78	.586	1:28.6
Early Dawn	1910	New York	1	16.22	1.065	1:15.2
Early Golden	1910	do	1	18.50	.848	1:21.8
Eldorado	1910	do	1	19.63	.784	1:25.0
Elvira	1909	Northern Ohio	8	14.29	1.002	1:14.3
Do	1909	Virginia	1	15.35	.735	1:20.9
Do	1910	Northern Ohio	4	17.16	.913	1:18.8
Do	1910	New York	4	14.23	1.253	1:11.4
Do	1911	Northern Ohio	1	13.57	.750	1:18.1
Do	1913	New York	4	14.16	1.288	1:11.0
Empire State	1910	All northern	2	16.10	.704	1:22.9
Etta	1909	Northern Ohio	1	11.24	1.369	1: 8.2
Eumelan	1910	do	1	13.54	.930	1:14.6
Do	1910	New York	4	17.80	.961	1:18.5
Do	1913	New Jersey	1	18.38	.706	1:26.0
Franken Riesling	1911	New York	1	18.15	1.208	1:15.0
Franklin	1913	New Jersey	1	18.41	1.188	1:15.5
Goethe	1913	do	1	15.12	.888	1:17.0
Goff	1910	New York	2	15.64	.895	1:17.5
Gold Dust	1910	do	1	15.71	.694	1:22.6
Golden	1910	do	1	17.04	.420	1:40.6
Glen'eld	1910	do	1	14.56	1.106	1:13.2
Green Early	1909	Northern Ohio	1	14.21	.758	1:18.8
Gut Edel	1909	do	1	20.20	1.144	1:17.7
Do	1910	do	1	20.36	1.350	1:15.1
Hayes	1909	do	1	18.45	.893	1:20.7
Do	1910	do	1	15.16	1.118	1:13.6
Hartford	1910	New York	2	15.81	.893	1:17.7
Herbert	1910	do	1	16.54	1.200	1:13.8
Herbemont	1913	New Jersey	1	15.55	.904	1:17.2
Hexamer	1910	New York	1	16.36	1.245	1:13.1
Hicks	1910	do	1	13.32	1.159	1:11.5
Honey Dew	1910	do	1	16.34	.956	1:17.1
Illinois City	1910	do	1	17.81	.998	1:17.8
Iona	1908	Northern Ohio	1	21.09	.679	1:31.1
Do	1909	All northern	4	19.78	.836	1:23.7
Do	1910	Northern Ohio	5	21.31	.866	1:24.6

[1] Acid average of 17 samples.

TABLE 3.—*Comparison of total sugar and acid results for all named varieties analyzed during 1908–1911 and 1913, with acid-sugar ratios*—Continued.

Variety.	Year.	District.	Number of samples.	Sugar as invert.	Acid as tartaric.	Acid-sugar ratio.
Iona	1910	New York	3	20.23	1.235	1:16.4
Do	1911	All northern	3	19.80	.717	1:27.6
Do	1913	New York	3	18.87	1.238	1:15.2
Isabella	1908	Northern Ohio	2	19.89	.540	1:36.8
Do	1909	All northern	6	13.91	1.008	1:13.8
Do	1910	do	9	16.75	.957	1:17.5
Do	1911	Northern Ohio	1	16.97	.645	1:26.3
Do	1913	New York	9	15.69	1:228	1:15.4
Ives	1908	Northern Ohio	19	16.12	.519	1:31.1
Do	1909	do	28	15.03	[1].766	1:19.6
Do	1909	Other northern	3	11.80	.788	1:15.0
Do	1909	Virginia	12	15.11	.753	1:20.1
Do	1910	Northern Ohio	18	16.84	.743	1:21.3
Do	1910	Other northern	4	16.03	.917	1:17.5
Do	1910	Virginia	15	15.38	.714	1:21.5
Do	1911	Northern Ohio	8	14.75	.609	1:24.3
Do	1911	Virginia	1	15.90	.750	1:21.2
Do	1913	New York	3	14.37	.843	1:15.9
Do	1913	New Jersey	12	13.77	.723	1:19.1
Janesville	1910	New York	1	13.95	1.462	1: 9.6
Jefferson	1913	New Jersey	1	17.45	.886	1:19.7
Jessica	1911	Northern Ohio	1	19.70	.450	1:43.8
Lenoir	1913	New Jersey	1	14.90	1.546	1 :9.6
Lindley	1910	New York	2	15.61	1.054	1:14.8
Do	1913	do	1	18.54	.720	1:25.8
Do	1913	New Jersey	1	16.92	.704	1:24.0
Lucile	1910	New York	2	14.46	.865	1:16.7
Marion	1909	Northern Ohio	1	20.77	1.718	1:12.1
Do	1910	New York	2	17.31	1.566	1:11.1
Martha	1909	do	1	16.07	.840	1:19.1
Massasoit	1910	do	1	15.21	.754	1:20.2
Maxfield	1913	do	1	15.87	.796	1:19.9
Mills	1910	do	2	19.85	.741	1:26.9
Missouri Riesling	1908	Northern Ohio	1	18.57	.656	1:28.3
Do	1909	do	3	19.13	.894	1:21.4
Do	1909	Virginia	1	14.30	.851	1:16.8
Do	1910	Northern Ohio	1	18.36	.941	1:19.5
Do	1911	do	2	17.20	.736	1:23.4
Do	1913	New Jersey	1	17.30	.886	1:19.5
Molitor	1911	Northern Ohio	1	20.36	1.006	1:20.2
Montefiore	1908	do	1	24.80	.401	1:61.8
Do	1909	do	4	19.96	.842	1:23.7
Do	1910	do	1	21.36	.784	1:27.2
Do	1911	All northern	2	17.32	.578	1:30.0
Moore Diamond	1913	New Jersey	1	17.48	.634	1:24.4
Moore Early	1910	New York	1	9.04	.825	1:11.0
Moyer	1910	do	2	17.61	.711	1:24.8
Munson	1910	do	1	13.57	1.490	1: 9.1
Nectar	1910	do	1	17.26	1.256	1:13.7
Niagara	1909	Northern Ohio	6	14.85	.615	1:24.1
Do	1909	Other northern	10	16.34	[2].683	1:23.9
Do	1910	Northern Ohio	2	18.92	.448	1:42.2
Do	1910	Other northern	6	13.87	.822	1:16.9
Do	1911	Northern Ohio	1	14.27	.570	1:25.0
Do	1911	Virginia	1	13.14	.810	1:16.2
Do	1913	New York	6	15.96	.617	1:25.9
Noah	1909	Virginia	2	20.06	.957	1:21.0
Do	1910	New York	1	14.25	1.632	1: 8.7
Do	1911	Virginia	1	20.25	.750	1:27.0
Do	1913	New Jersey	3	16.46	1.099	1:14.9
Norton	1908	Northern Ohio	3	25.27	1.006	1:25.1
Do	1908	Virginia	9	22.63	1.088	1:20.8
Do	1909	Northern Ohio	11	19.50	1.812	1:10.8
Do	1909	Virginia	11	21.35	.925	1:23.1
Do	1910	Northern Ohio	5	21.41	1.683	1:12.7
Do	1910	Virginia	23	22.44	.957	1:23.4
Do	1911	Northern Ohio	4	22.30	1.262	1:17.8
Do	1911	New York	1	20.21	2.212	1: 9.1
Do	1911	Virginia	7	21.49	.867	1:24.8
Do	1913	New Jersey	3	17.67	1.390	1:12.7
Norfolk	1910	New York	1	16.10	1.144	1:14.1
Olita	1910	do	1	15.97	.908	1:17.6
Pierce	1910	do	1	12.42	1.253	1: 9.9
Pocklington	1909	All northern	3	16.85	.700	1:24.1
Do	1910	Northern Ohio	2	17.04	.846	1:20.1

[1] Acid average of 26 samples.

[2] Acid average of 9 samples.

TABLE 3.—*Comparison of total sugar and acid results for all named varieties analyzed during 1908–1911 and 1913, with acid-sugar ratios*—Continued.

Variety.	Year.	District.	Number of samples.	Sugar as invert.	Acid as tartaric.	Acid-sugar ratio.
Prentiss	1913	New York	1	17.47	0.728	1:24.0
Regal	1910	do	1	16.11	.836	1:19.3
Requa	1910	do	1	16.75	.844	1:19.8
Rogers	1909	do	1	18.10	1.035	1:17.5
Rogers No. 24	1910	do	1	13.19	1.238	1:10.7
Rogers No. 32	1910	do	1	15.43	1.181	1:13.1
Rupert	1910	do	1	13.28	1.756	1: 7.6
St. Louis	1910	do	1	13.31	1.140	1:11.7
Salem	1909	Northern Ohio	1	17.61	.510	1:34.5
Do	1910	All northern	3	20.17	.828	1:24.4
Do	1913	New York	2	19.64	.904	1:21.7
Do	1913	New Jersey	1	17.41	1.085	1:16.0
Schraidt	1908	Northern Ohio	1	18.23	1.294	1:14.1
Do	1909	do	3	17.50	1.823	1: 9.6
Do	1910	do	2	18.28	1.594	1:11.5
Do	1911	do	3	18.85	1.600	1:11.8
Seibel	1911	New York	1	11.10	1.852	1: 6.0
Taylor	1913	New Jersey	2	17.57	1.326	1:13.3
Telegraph	1910	New York	1	13.90	1.256	1:11.1
Tragedy	1910	do	1	16.65	.776	1:21.5
Triumph	1910	do	1	14.09	1.354	1:10.4
Do	1911	do	1	11.09	1.012	1:11.0
Ulster	1913	New Jersey	1	19.23	.684	1:28.1
Vergennes	1910	New York	3	17.34	1.082	1:16.0
Wapanuka	1910	do	1	9.42	1.084	1: 8.7
Wilder	1909	Northern Ohio	1	14.44	1.020	1:14.2
Do	1910	New York	1	14.11	1.189	1:11.9
Winchell	1913	New Jersey	1	19.28	.506	1:38.1
Woodruff	1909	Northern Ohio	1	14.34	.409	1:35.1
Do	1913	New Jersey	1	13.54	.660	1:20.5
Worden	1909	Northern Ohio	2	17.24	.709	1:24.3
Do	1910	All northern	15	16.46	.998	1:16.5
Do	1911	New York	2	13.12	.922	1:14.2
Wyoming Red	1910	do	2	13.29	.805	1:16.5

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